



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.05.2001 Bulletin 2001/21

(51) Int Cl.7: **B60H 1/00**

(21) Application number: **00309564.3**

(22) Date of filing: **30.10.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
 Designated Extension States:
AL LT LV MK RO SI

- **Pothen, Kurian**
West Bloomfield, Michigan 48323 (US)
- **Mourad, Matthew**
Oxford, Michigan 48370 (US)
- **Thrift, Charles D.**
Farmington Hills, Michigan 48331 (US)

(30) Priority: **18.11.1999 US 442586**

(71) Applicant: **TI Group Automotive Systems Corporation**
Warren, Michigan 48090-2001 (US)

(74) Representative: **Atkinson, Ralph et al**
Atkinson Burrington,
27-29 President Buildings,
President Way
Sheffield S4 7UR (GB)

(72) Inventors:
 • **Hartnagel, Philip S.**
Rochester, Michigan 48306 (US)

(54) **Tube assembly for auxiliary heating and air conditioning system**

(57) A tube assembly for an auxiliary heating and air conditioning system includes an inner tube (12) extending longitudinally, an outer tube (18) extending longitudinally and disposed over the inner tube, the outer tube including a plurality of ribs (20A) for locating the inner

tube approximately concentric to the outer tube, at least one connector tube (36), and at least one connector (24) interconnecting the at least one connector tube and the outer tube to allow fluid flow between the inner tube and the outer tube.

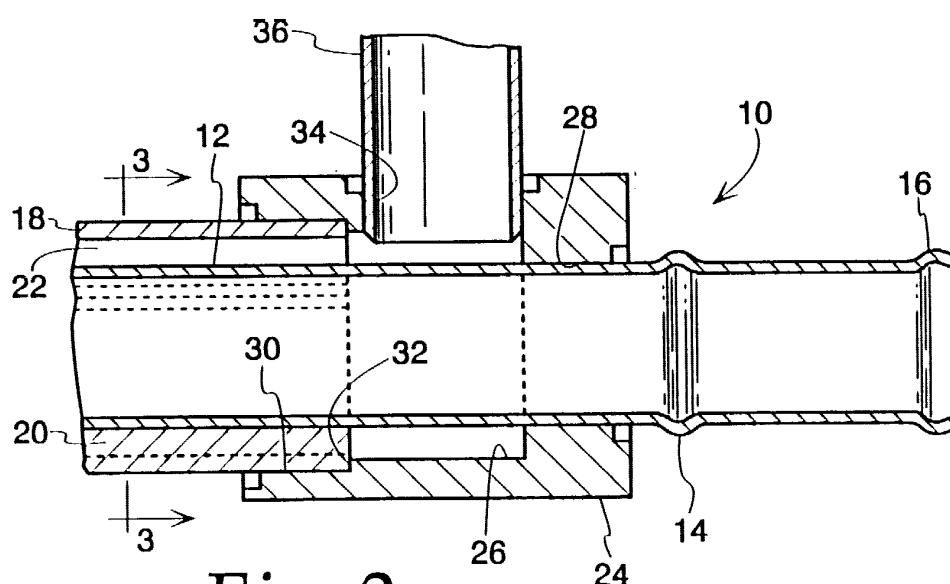


Fig. 2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally, to heating and air conditioning systems and, more particularly, to a tube assembly for an auxiliary heating and air conditioning system of a motor vehicle.

2. Description of the Related Art

[0002] Motor vehicles typically include a heating and air conditioning system for heating and cooling of an occupant compartment of the motor vehicle. Often, these heating and air conditioning systems include an auxiliary heating and air conditioning system. Typically, a fluid supply line extends from a main heating and air conditioning system to the auxiliary heating and air conditioning system and a fluid return line extends from the auxiliary heating and air conditioning system to the main heating and air conditioning system.

[0003] One disadvantage of the above is that separate lines are needed for supply and return of fluid which creates a packaging problem. Another disadvantage of the above is that there is no heat exchange between the supply and return lines. Thus, there is a need in the art to provide a new and improved tube assembly for the auxiliary heating and air conditioning system.

SUMMARY OF THE INVENTION

[0004] It is, therefore, one object of the present invention to provide a tube assembly for an auxiliary heating and air conditioning system of a motor vehicle.

[0005] It is another object of the present invention to improve the packaging and performance of an auxiliary heating and air conditioning system for a motor vehicle.

[0006] To achieve the foregoing objects, the present invention is a tube assembly for an auxiliary heating and air conditioning system of a motor vehicle. The tube assembly includes an inner tube extending longitudinally and an outer tube extending longitudinally and disposed over the inner tube. The outer tube includes a plurality of ribs for locating the inner tube approximately concentric to the outer tube. The tube assembly includes at least one connector tube and at least one connector interconnecting the at least one connector tube and the outer tube to allow fluid flow between the inner tube and outer tube.

[0007] One advantage of the present invention is that a new and improved tube assembly for an auxiliary heating and air conditioning system is provided on a motor vehicle. Another advantage of the present invention is that the tube assembly improves packaging and performance of an auxiliary heating and air conditioning system. Yet another advantage of the present invention

is that the tube assembly incorporates a concentric tube design for better packaging, performance and weight.

[0008] Other objects, features and advantages of the present invention will be readily appreciated as the same becomes better understood after reading the subsequent description when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is an elevational view of a tube assembly, according to the present invention, for an auxiliary heating and air conditioning system.

[0010] FIG. 2 is a fragmentary elevational view of the tube assembly of FIG. 1.

[0011] FIG. 3 is a sectional view of a first embodiment of the outer tube taken along line 3-3 of FIG. 2.

[0012] FIG. 4 is a sectional view of a second embodiment of the outer tube taken along line 3-3 of FIG. 2.

[0013] FIG. 5 is a sectional view of a third embodiment of the outer tube taken along line 3-3 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Referring to FIGS. 1 through 3, a tube assembly 10, according to the present invention, is shown for an auxiliary heating and air conditioning system (not shown) of a motor vehicle (not shown). The tube assembly 10 includes an inner tube 12 extending longitudinally to supply fluid such as water from a front or main heating and air conditioning system (not shown) to the rear or auxiliary heating and air conditioning system. The inner tube 12 is hollow and has a generally circular cross-sectional shape. The inner tube 12 may have bead 14 and a radially expanded end 16 for connection to a hose (not shown). The inner tube 12 is made of a rigid material such as a metal material.

[0015] The tube assembly 10 also includes an outer tube 18 extending longitudinally and disposed over the inner tube 12. The outer tube 18 is hollow and has a generally circular cross-sectional shape and also has the same cross sectional area as the inner tube 12. The outer tube 18 includes a plurality of ribs 20 extending radially inwardly and longitudinally to locate or center the inner tube 12 relative to the outer tube 18 such that they are approximately concentric. The ribs 20 also divide the interior of the outer tube 18 into a plurality of channels 22 to allow fluid flow longitudinally between the outer tube 18 and inner tube 12.

[0016] A first embodiment of the outer tube 18 is illustrated in FIG. 3. The outer tube 18A has three ribs 20A dividing the interior of the outer tube into three channels 22B. The three ribs 20A are provided approximately one hundred twenty degrees apart to provide the three channels 22A.

[0017] To provide additional reliability or durability to the tube assembly, a second embodiment of the outer

tube 18B, as illustrated in FIG. 4, has four ribs 20B dividing the interior of the outer tube into four channels 22B. The four ribs 20B are provided approximately ninety degrees apart to provide the four channels 22B.

[0018] To provide further additional reliability or durability to the tube assembly, a third embodiment of the outer tubing 18C, as illustrated in FIG. 5, has five ribs 20C dividing the interior of the outer tube into five channels 22C. The five ribs 20C are provided approximately seventy two degrees apart to provide the five channels 22C.

[0019] The outer tube 18 is made of a rigid material such as a metal material.

[0020] The tube assembly 10 includes at least one, preferably a plurality of connectors 24. Each connector 24 is generally cylindrical in shape and has a cavity 26 in one longitudinal end thereof and a first passageway 28 extending through the first other longitudinal end and communicating with the cavity 26. The inner tube 12 extends through the first passageway 28 and cavity 26 and the bead 14 prevents the connector 24 from exiting the end of the inner tube 12.

[0021] Each connector 24 also includes a radially enlarged opening 30 at one end of the cavity 26 to receive the outer tube 18. The enlarged opening 30 forms a shoulder 32 with the cavity 26 which acts as a stop to locate the outer tube 18 within the connector 24. It should be appreciated that the outer tube 18 is press-fit into the connector 24.

[0022] Each connector 24 further includes a second passageway 34 in one side of the connector 24 and communicating with the cavity 26. Preferably, the second passageway 34 is generally perpendicular or radial to the first passageway 28.

[0023] The tube assembly 10 also includes a connector tube 36 connected to each connector 24 to return fluid such as water from the rear or auxiliary heating and air conditioning system to the front or main heating and air conditioning system. The connector tube 36 is hollow and has a generally circular cross-sectional shape. The connector tube 36 has one end disposed in the second passageway 34 of the connector 24 and preferably press-fit therein. The connector tube 36 is made of a relatively rigid material such as a metal material.

[0024] In operation, fluid such as water flows from the front or main heating and air conditioning system through the inner tube 12 to the rear or auxiliary heating and air conditioning system. Simultaneously, fluid such as water flows from the rear or auxiliary heating and air conditioning system through the connector tube 36 at one end to the cavity 26 of the connector 24 and along the channels 22 between the outer tube 18 and inner tube 12 to the cavity 26 of the other connector 24 and through the other connector tube 36 to the front or main heating and air conditioning system. It should be appreciated that heat transfer occurs between the fluid of the inner tube 12 and the fluid of the outer tube 18 if there is a temperature difference between the two.

[0025] The present invention has been described in an illustrative manner. It is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

[0026] Many modifications and variations of the present invention are possible in light of the above teachings. Therefore, within the scope of the appended claims, the present invention may be practiced other than as specifically described.

Claims

11. A tube assembly for a heating and air conditioning system comprising:

an inner tube extending longitudinally;
an outer tube extending longitudinally and disposed over said inner tube;
a connector tube;
a connector interconnecting said connector tube and said outer tube to allow fluid flow between said inner tube and said outer tube, said inner tube extending through said connector; wherein said inner tube includes a bead located longitudinally outwardly of said connector for preventing said connector from exiting said inner tube;
said outer tube including a plurality of ribs for locating said inner tube approximately concentric to said outer tube; and
said ribs extending longitudinally and radially inwardly and are spaced approximately ninety degrees apart.

12. A tube assembly as set forth in Claim 11 wherein said connector includes a cavity in one longitudinal end and a first passageway extending through another longitudinal end and communicating with said cavity.

13. A tube assembly as set forth in Claim 12 wherein said connector includes a second passageway extending into and communicating with said cavity, said connector tube being disposed in said second passageway.

14. A tube assembly as set forth in Claim 12 wherein said cavity includes a radially enlarged opening to receive said outer tube.

15. A tube assembly as set forth in Claim 14 wherein said connector includes a shoulder between one end of said cavity and said enlarged opening to locate said outer tube within said connector.

16. A tube assembly for a heating and air conditioning system comprising:

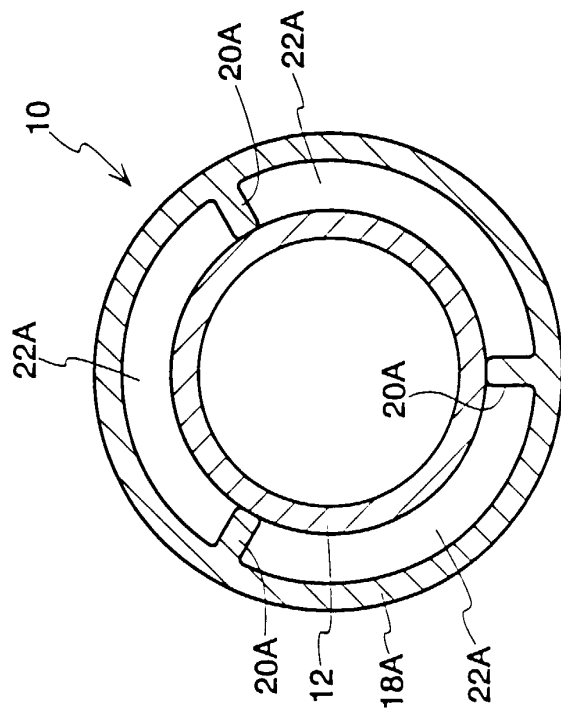
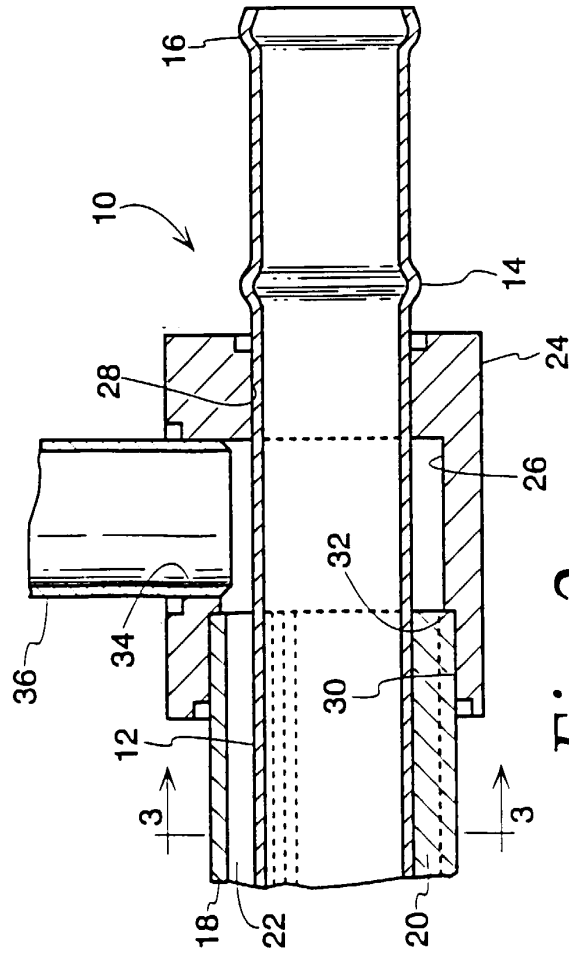
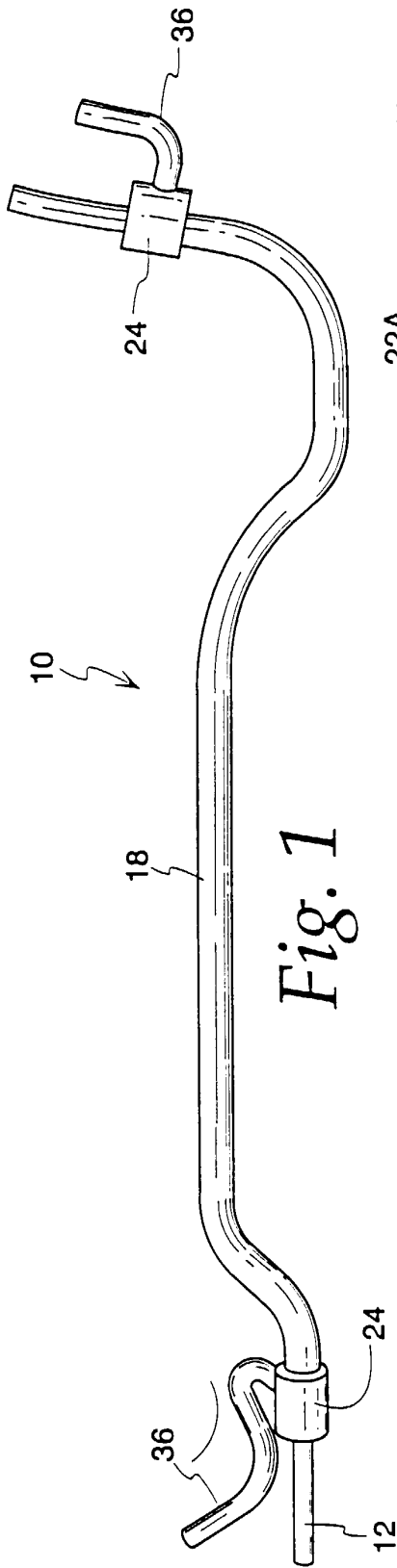
an inner tube extending longitudinally;
an outer tube extending longitudinally and disposed over said inner tube;
a connector tube;
a connector interconnecting said connector tube and said outer tube to allow fluid flow between said inner tube and said outer tube, said inner tube extending through said connector, wherein said inner tube includes a bead located longitudinally outwardly of said connector for preventing said connector from exiting said inner tube;
said outer tube including a plurality of ribs for locating said inner tube approximately concentric to said outer tube; and
said ribs extending longitudinally and radially inwardly and are spaced approximately seventy two degrees apart.

17. A tube assembly as set forth in Claim 16 wherein said connector includes a cavity in one longitudinal end and a first passageway extending through another longitudinal end and communicating with said cavity.

18. A tube assembly as set forth in Claim 17 wherein said connector includes a second passageway extending into and communicating with said cavity, said connector tube being disposed in said second passageway.

19. A tube assembly as set forth in Claim 17 wherein said cavity includes a radially enlarged opening to receive said outer tube.

20. A tube assembly as set forth in Claim 19 wherein said connector includes a shoulder between one end of said cavity and said enlarged opening to locate said outer tube within said connector.



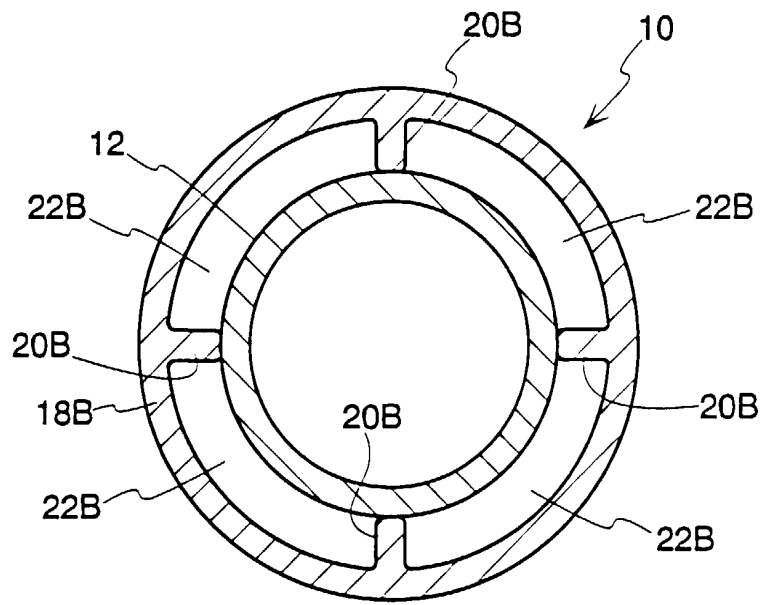


Fig. 4

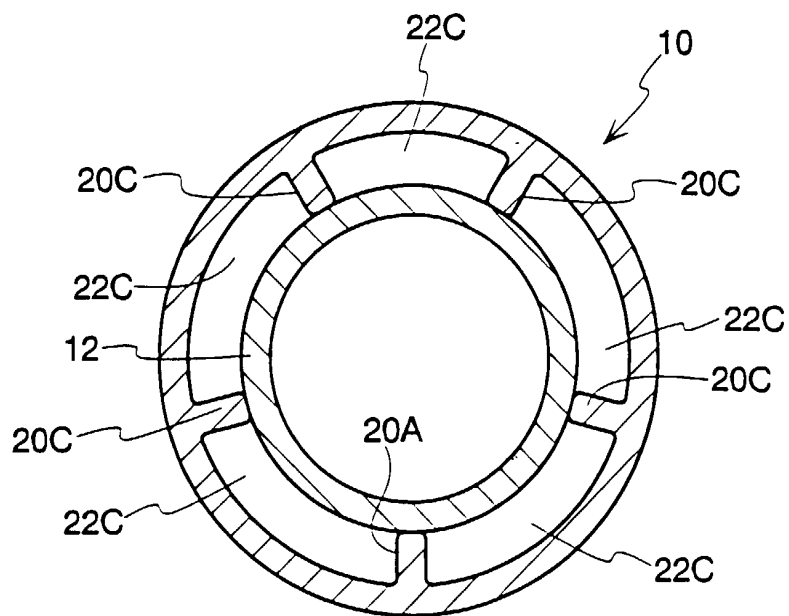


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 9564

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 99 23433 A (BUNDY CORP) 14 May 1999 (1999-05-14) * the whole document *	11-20	B60H1/00
A	US 5 456 502 A (SHARP BRUCE R) 10 October 1995 (1995-10-10) * column 1, line 56 - line 61 * * column 3, line 24 - line 50 * * column 4, line 61 - column 5, line 2 * * figures 2,3,6,7 *	11,16	
A	US 5 611 373 A (TIMOTHY A. ASHCRAFT) 18 March 1997 (1997-03-18) * column 2, line 39 - line 44 * * column 4, line 40 - line 57 * * figures 2,3 *	11-20	
A	US 2 410 912 A (EDWARD A. WENK) 12 November 1946 (1946-11-12) * column 1, line 1 - line 3 * * column 2, line 5 - line 10 * * column 2, line 28 - line 35 * * column 3, line 30 - line 42 * * figure 2 *	11-20	
A	DE 33 03 373 A (MAYER HERBERT) 2 August 1984 (1984-08-02) * page 4, line 1 - line 8 * * figure 1 *	11,16	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7) B60H F16L F28D
Place of search		Date of completion of the search	Examiner
THE HAGUE		26 February 2001	van der Bijl, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 30 9564

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-02-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9923433 A	14-05-1999	US 6009908 A	04-01-2000
		AU 1368599 A	24-05-1999
		BR 9813145 A	15-08-2000
		CN 1278323 T	27-12-2000
		EP 1027570 A	16-08-2000
		US 6131615 A	17-10-2000
		US 6145545 A	14-11-2000
US 5456502 A	10-10-1995	BR 9303627 A	28-03-1995
		CA 2101818 A	04-02-1995
		DE 4329147 A	02-03-1995
		GB 2281111 A	22-02-1995
		US 5259651 A	09-11-1993
		US 5547231 A	20-08-1996
		US 5449203 A	12-09-1995
US 5611373 A	18-03-1997	AU 5671896 A	18-11-1996
		WO 9634222 A	31-10-1996
		US 5628532 A	13-05-1997
US 2410912 A	12-11-1946	NONE	
DE 3303373 A	02-08-1984	NONE	